<u>REMARKS</u>

This amendment responds to the office action mailed October 2, 2002. In the office action the Examiner:

- Rejected claims 1 and 2 under 35 U.S.C. 102(e) as anticipated by Hildebrand (U.S. Patent. No. 5,727,074). We will treat the 35 U.S.C. 102 rejection as a 35 U.S.C. 103 rejection as well, and respond accordingly.
- Rejected claims 8, 13 and 14 under 35 U.S.C. 103 as being unpatentable over Hildebrand in view of Wood (U.S. Patent. No. 6,178,514).
- Objected to claims 3-7, 9-12 and 15-18 as being dependent on a rejected base claim, but otherwise allowable if re-written in independent form.

After entry of this amendment, the pending claims are: claims 1 - 20.

Applicants respectfully traverse the rejections and objections stated in the Office Action.

Hildebrand is not applicable to the claimed invention as defined by the amended claims, as Hildebrand "does not relate to multi-band equalizers...." (See Hildebrand, column 3, lines 40-45). Hildebrand relates to "digital time domain filters" (See Hildebrand, column 3, lines 46-51; column 5, lines 34-48). By definition, a time domain filter operates in the time domain, not the frequency domain. Since a multi-band equalizer, by definition, operates in the frequency domain mechanism, the Hildebrand time domain filter cannot be a "multi-band equalizer".

The present claimed invention concerns multi-band equalizers, as shown, for example, at: page 6, lines 24-32; page 7, lines 21-23; page 8, lines 4-7 and 19-32; Figures 5, 8 and 9; and claims 4-7. As such, Hildebrand has no bearing on the present application and the amended pending claims.

The amendments to claim 1 are supported at least by: Figure 6 and the specification at page 6, lines 24-30, and page 7, lines 12-18. No new matter has been added to claim 1 by these amendments.

In furtherance of the distinction described above between Hildebrand's time domain filter and the filter claimed in the present application, Applicants have amended claim 1 to recite in part that the parametric equalizer comprises "a plurality of equalizer bands...." Again, Hildebrand does not apply to multi-band equalizers.

Claim 1 also recites: "a first set of instructions to **automatically determine a type of a speaker** of the computer." Contrary to the Examiner's argument, Hildebrand does not teach or suggest determining the speaker type. Hildebrand teaches measuring the output of a speaker (See e.g. column 11, lines 1-20, and Figure 6) and then using various transform functions to create a digital time-domain equalizer. In the Hildebrand methodology, ten speakers of the same brand and model (i.e., of identical type) would inevitably have slightly different measurements and Hildebrand would produce slightly different transform functions for each of the them. Hildebrand teaches no methodology for distinguishing between speakers that are of the same type, and thus very similar to each other, and speakers that are of different types. Hildebrand treats all speakers as being unique instruments, producing a customized time domain filter for each.

As described in the specification of the present application at pages 7 and 8 and Figure 6, determining a speaker type involves determining whether the speaker is a USB speaker or not, and if so, the speaker will identify its type to the Equalizer Activator. By so determining the speaker type, the Equalizer Activator will then choose default equalizer coefficients stored in memory. Hildebrand does not teach or suggest such determination and use of a speaker type

for a multi-band filter, which again is not the same as the digital time domain filter taught in Hildebrand.

With regard to the word "automatically" that has been added to claim 1, Hildebrand teaches away from automatically determining a speaker type, as Hildebrand requires human interaction and effort in taking individual speaker measurements to develop filter parameters (See, e.g. Figure 6 and column 11, lines 1-20). The present invention operates automatically, without human assistance. This issue is discussed further below, with respect to claims 8 and 13.

Claim 1 further recites: "a second set of instructions to **select a set of filter coefficients for a digital filter based upon the type of the speaker.**" Hildebrand does not teach or suggest this element. As stated in the previous paragraph, Hildebrand does not employ the speaker type in its calculations, but rather uses test measurements of the speaker output to develop a filter.

Respectfully, Hildebrand does not teach the invention to which independent claim 1 is directed, nor claims 2-7 that depend from claim 1. Claims 2-7 should be allowable for at least the reasons that claim 1 is allowable.

Amendments to claims 3, 5, 6 and 7 add no new matter. These amendments are supported at least by Figures 7 and 9; the specification at page 9, line 1 through page 10, line 16; and original claims 3, 5, 6 and 7.

Amendments to independent claims 8 and 13 are supported at least by: Figure 6 and the specification at page 6, lines 24-30, and page 7, lines 12-18. No new matter has been added to claims 8 and 13 by these amendments.

The above remarks relating to claim 1 apply similarly to claims 8 and 13. Neither Hildebrand nor Wood teach or suggest a multi-band equalizer or the use of the speaker type to

determine an equalizer. Further the Examiner admits in the office action that Hildebrand fails to disclose a USB loud speaker. Wood does mention USB speakers and the fact that such speakers will identify themselves upon being queried by the system. However, Hildebrand teaches away from automatically determining a speaker type, as Hildebrand requires human interaction and effort in taking individual speaker measurements to develop filter parameters (See, e.g. Figure 6 and column 11, lines 1-20). As such, Applicants disagree with the suggestion in the office action that one of ordinary skill in the art would have been motivated to modify Hildebrand in light of Wood.

Respectfully, Hildebrand and Wood do not teach the invention to which independent claims 8 and 13 are directed, nor claims 9-12 and 14-18 that depend from claims 8 and 13, respectively. Claims 9-12 and 14-18 should be allowable for at least the reasons that claims 8 and 13 are allowable.

Amendments to claims 9-12 and 15-18 add no new matter. These amendments are supported at least by: Figures 7 and 9; the specification at page 9, line 1 through page 10, line 16; and original claims 9-12 and 15-18.

New claims 19 and 20 are supported at least by: original claims 1, 4, 13 and 15; Figure 6; and the specification at page 6, lines 24-30, and page 7, lines 12-18. No new matter had been added by these new claims.

Claims 19 and 20 recite in pertinent part first, second and third equalizer bands having respective first, second and third cut/boost parameters. As stated above in relation to claims 1, 8 and 13, neither Hildebrand nor Wood teach or suggest such multi-band equalizer elements. Claims 19 and 20 should be allowable for the same reasons that claims 1, 8 and 13 are allowable. Claims 19 and 20 should also be allowable for the same reasons that claims 4 and 15 are allowable.

In light of the above amendments and remarks, the Applicant respectfully requests that the Examiner reconsider this application with a view towards allowance. The Examiner is invited to call the undersigned attorney if a telephone call could help resolve any remaining items.

Respectfully submitted,

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Appendix A
Changes to the Specification

The paragraph at page 5 Line 28 is revised as follows:

Still referring to Figure 3, speaker 24 enables computer system 20 to play music CDS and to provide game sound effects. There are a number of commercially available speakers for personal computers, including, for example, the LCS-150 produced by LABTAC of Vancouver, Washington, and the SB-881A produced by Pontech of Taiwan. Alternatively, speaker 24 may be a USB speaker, able to identify its type to system 20. (In which case, bus 44 will be a USB.) Each commercially available speaker has a different frequency response; however, none of them produces the sound quality most consumers have come to expect. Audio system 22 improves the perceived sound quality of speaker 24 by implementing the digital parametric equalizer 23 of the present invention. Audio system 22 does so using Equalizer Activator 30, Equalizer Interface 32, AudioCard Interface [32] <u>34</u> and AudioCard 28. AudioCard 28 may be realized using any commercially available personal computer audio card, including for example, the OTI-608 AC'97 Audio Codec produced by Oak Technology of Sunnyvale, California.

The paragraph at page 8 Line 19 is revised as follows:

Equalizer Interface 32 begins by presenting an equalizer user interface to a computer user during step 70. The equalizer user interface allows the computer user to manually modify the equalizer parameters for each band. Figure 8 illustrates one possible implementation of the equalizer user interface, graphical user interface 82, which resembles a conventional analog equalizer. Other implementations of the equalizer user interface are compatible with the present invention and need not be described in detail herein. Upon its initial presentation, equalizer user interface indicates

the default equalizer parameter values selected by Equalizer Activator 30. After presenting the equalizer user interface, during step 72 Equalizer Interface 32 monitors the equalizer user interface for any indication that the user is manually modifying an equalizer parameter. For example, moving a slider bar 84 or selecting an input window 86 both indicate a possible alteration of a band's parameter values. In response, Equalizer Interface [26] 32 examines slider bar positions and input windows to determine each band's equalizer parameter values.

The paragraph at page 9 Line 29 is revised as follows:

During step 94 Insure Sound Quality 74 estimates whether the total combined [gain] cut/boost of the non-adjacent bands, Band1 50 and Band3 54, is acceptable using Relationship 8.

The paragraph at page 10 Line 6 is revised as follows:

As with the relationship for adjacent bands, the precise value, Y, that the combined cut/boost of non-adjacent bands should be less than will vary depending upon the personal computer audio card used. A total combined cut/boost for non-adjacent bands of 0.75, or less, is preferred when using a sixteen bit Audio Codec, such as the OTI 608, to realize AudioCard 28. As discussed previously with respect to X, higher values of Y are possible when realizing AudioCard 28 with a twenty-four bit or more Audio Codec.

The paragraph at page 11 Line 8 is revised as follows:

Referring once more to Figure 5, Filter 29 of digital parametric equalizer 23 may be realized using the improved four-multiply normalized ladder filter of the present invention. The improved normalized four-multiply ladder filter produces symmetrical cut and boost spectrums. As a result, the performance of equalizer 23 more closely

approximates that of ideal equalizers, enabling frequencies to be cut as deeply as they are boosted. This improved filter is similar, but not identical, to the prior four-multiply normalized ladder filter discussed above. Specifically, filter 29 uses the signal flow diagram of Figure 1, the transfer function of Relationship 1, the first [turning] tuning coefficient of Relationship 3, the first filter coefficient of Relationship 5 and the second filter coefficient of Relationship 6. Despite these similarities between filter [30] 29 and the prior art filter, each equalizer band 50, 52 and 54 produces an output signal with symmetrical cut and boost spectrums. This performance gain arises from the present invention's understanding and use of the second tuning coefficient, k_2. Analysis revealed that the second tuning coefficient, k_2, caused the asymmetry between cut and boost spectrums produced by prior art devices. Further analysis revealed that a filter's cut and boost spectrums could be made symmetrical using one Relationship for k_2 while boosting and using another Relationship for k_2 while cutting. These conditions are described by Relationships 9 and 10.

The paragraph at page 12 Line 16 is revised as follows:

During step 120, for the selected band, Instructions 105 first examine the value of the cut/boost parameter to determine whether that band is to cut or boost its input signal. If the value of the cut/boost parameter is equal to one or greater, the band will be boosting, then Instructions 105 use a Boost Relationship to calculate the second tuning coefficient, k_2. The Boost Relationship used during step 122 is Relationship [7] 9, set forth above. On the other hand, if the value of the band's cut/boost parameter is less than one, then during step 124 Instructions 105 use a Cut Relationship to calculate the value of the second tuning coefficient, k_2. The Cut Relationship used during step [94] 124 is Relationship [8] 10, also set forth above.

Appendix B

Changes to the Claims

The rewritten claims were revised as follows:

1. (Amended) A computer readable memory to direct a computer to function in a specified manner, comprising:

a first set of instructions to automatically determine a type of a speaker of the computer;

a second set of instructions to select a set of filter coefficients for a digital filter based upon the type of the speaker; and

a third set of instructions to realize a parametric equalizer using [a] the digital filter, the digital filter producing an output signal to be input to the speaker from the set of filter coefficients and an input signal;

wherein the parametric equalizer comprises a plurality of equalizer bands, each equalizer band having one or more filters.

3. (Amended) The computer readable memory of claim 2 further comprising:

a sixth set of instructions for insuring that a value of a cut/boost parameter of the user specified equalizer parameters [is not too great] meets predefined mathematical criteria.

5. (Amended) The computer readable memory of claim 4 further comprising:

a tenth set of instructions for insuring a first combined cut/boost of the first, second and third equalizer bands [is not too great] meets predefined mathematical criteria.

6. (Amended) The computer readable memory of claim 5 wherein the tenth set of instructions comprise:

an eleventh set of instructions to determine whether a second combined cut/boost of the first equalizer band and the second equalizer band [is too great] <u>meets predefined mathematical criteria</u>;

a twelfth set of instructions to determine whether a third combined cut/boost of the second equalizer band and the third equalizer band [is too great] <u>meets predefined mathematical criteria</u>; and

a thirteenth set of instructions to determine whether a fourth combined cut/boost of the first equalizer band and the third equalizer band [is too great] <u>meets predefined mathematical criteria</u>.

7. (Amended) The computer readable memory of claim 6 wherein:

the eleventh set of instructions uses a relationship for adjacent bands to determine whether the second combined cut/boost [is too great] <u>meets predefined mathematical criteria</u>;

the twelfth set of instructions uses the relationship for adjacent bands to determine whether the third combined cut/boost [is too great] <u>meets predefined mathematical criteria</u>; and

the thirteenth set of instructions uses a relationship for non-adjacent bands to determine whether the fourth combined cut/boost [is too great] <u>meets predefined mathematical criteria</u>.

8. (Amended) A method for improving audio quality of a computer including a Universal Serial Bus (USB) loud speaker, the method comprising the steps of:

<u>a) determining automatically a type of the USB loud speaker of the computer</u>;

[a)] b) designating a first set of filter coefficients as a selected set of filter coefficients if the USB loud speaker is of a first type;

[b)] c) designating a second set of filter coefficients as the selected set of filter coefficients if the USB loud speaker is of a second type;

[c)] d) calculating a third set of filter coefficients from equalizer parameters of a parametric equalizer if user specified equalizer parameters are received;

[d)] e) designating the third set of filter coefficients as the selected coefficients if user specified equalizer parameters are received; and

[e)] f) realizing a parametric equalizer using a digital filter, the digital filter generating an output signal to be input to the USB loud speaker from an input signal and the selected set of coefficients;

wherein the parametric equalizer comprises a plurality of equalizer bands, each such equalizer band having one or more filters.

9. (Amended) The method of claim 8 further comprising the step of:

[f)] g) insuring that a value of a cut/boost parameter of the parametric equalizer [is not too great] meets predefined mathematical criteria.

10. (Amended) The method of claim [9] 8 wherein the parametric equalizer includes a first equalizer band, a second equalizer band and a third equalizer band.

11. (Amended) The method of claim 10 wherein step [f] g comprises the substeps of:

[f1)] g1) determining whether a first combined cut/boost of the first equalizer band and the second equalizer band [is too great] meets predefined mathematical criteria;

[f2)] g2) determining whether a second combined cut/boost of the second equalizer band and the third equalizer band [is too great] meets predefined mathematical criteria; and

[f3)] g3) determining whether a third combined cut/boost of the first equalizer band and the third equalizer band [is too great] meets predefined mathematical criteria.

12. (Amended) The method of claim 11 wherein steps [f1] g1 and [f2] g2 use a relationship for adjacent bands and step [f3] g3 uses a relationship for non-adjacent bands.

13. (Amended) A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism comprising one or more modules to improve audio quality of the computer system, the one or more modules including:

a first set of instructions to automatically determine a type of a Universal Serial Bus (USB) speaker of the computer system;

a second set of instructions to select a set of filter coefficients for a digital filter based upon the type of the USB speaker; and

a third set of instructions to realize a parametric equalizer using a digital filter, the digital filter producing an output signal to be input to the USB speaker from the set of filter coefficients and an input signal;

wherein the parametric equalizer comprises a plurality of equalizer bands, each such equalizer band having one or more filters.

15. (Amended) The computer program product of claim 14 wherein the third set of instructions comprise:

a seventh set of instructions to realize a first equalizer band of the parametric equalizer, the first equalizer band having a first cut/boost parameter;

[and] <u>an</u> eighth set of instructions to realize a second equalizer band of the parametric equalizer, the second equalizer band having a second cut/boost parameter; and

a ninth set of instructions to realize a third equalizer band of the parametric equalizer, the third equalizer band having a third cut/boost parameter.

16. (Amended) The computer program product of claim 15 wherein a tenth set of instructions for insuring a first combined cut/boost of the first, second and third equalizer bands [is not too great] <u>meets predefined mathematical criteria</u>.

17. (Amended) The computer program product of claim 16 wherein the tenth set of instructions comprise:

an eleventh set of instructions to determine whether a second combined cut/boost of the first equalizer band and the second equalizer band [is too great] <u>meets predefined mathematical criteria</u>;

a twelfth set of instructions to determine whether a third combined cut/boost of the second equalizer band and the third equalizer band [is too great] <u>meets predefined mathematical criteria</u>; and

a thirteenth set of instructions to determine whether a fourth combined cut/boost of the first equalizer band and the third equalizer band [is too great] <u>meets predefined mathematical criteria</u>.

18. (Amended) The computer program product of claim 17 wherein:

the eleventh set of instructions uses a relationship for adjacent bands to determine whether the second combined

cut/boost [is too great] <u>meets predefined mathematical criteria</u>;

the twelfth set of instructions uses the relationship for adjacent bands to determine whether the third combined cut/boost [is too great] <u>meets predefined mathematical criteria</u>; and

the thirteenth set of instructions uses a relationship for non-adjacent bands to determine whether the fourth combined cut/boost [is too great] <u>meets predefined mathematical criteria</u>.